CLAIMS:

1. A method for the preparation of optimally labeled oligonucleotides, said method comprising the steps of:

(a) preparing a primer;

(b) preparing a template oligonucleotide, said template oligonucleotide containing a nucleotide sequence complementary to said primer, and a nucleotide repeat region downstream from said complementary region;

(c) annealing the template and the primer in a suitable reaction medium, said reaction medium containing a polymerase, nucleotide triphosphates and label-conjugated nucleotide triphosphates;

(d) initiating synthesis of a complementary strand on the template;

(e) attaching said oligonucleotide containing a target sequence adjacent to said complementary strand; and

(f) purifying said optimally labeled oligonucleotide by any appropriate method.

2. The method of claim 1 wherein said primer is labeled with ^{32}P.

3. The method of claim 1 wherein said nucleotide repeat region has the formula: $N^t(N^t)_n N^t$ wherein N^t is any nucleotide which can form a base pair with the label-conjugated nucleotide triphosphate, and n is an integer from 20 to 1000.

4. The method of claim 1 wherein said nucleotide repeat region has the formula: $N^t(N_mN^t)_n N_m$ wherein N is any nucleotide which cannot form a base pair with the label—conjugated nucleotide triphosphate, N^t is any nucleotide which can form a base pair with the label-conjugated nucleotide triphosphate, n is an integer from 20 to 1000, and m is an integer from 1 to 11.

5. The method of claim 1 wherein said attachment step comprises ligation.

6. The method of claim 1 wherein said attachment step comprises randomer extension.

7. The method of claim 1 wherein said attachment step comprises cloning.

8. The method of claim 1 wherein said purification method is selected from the group consisting of precipitation, size fractionation, gel electrophoresis and antigen–specific binding.

9. A method for the preparation of optimally labeled oligonucleotides, said method comprising the steps of:

(a) preparing a template, said template comprising a primer binding region, a 5′ extension region for the subsequent incorporation of label–conjugated nucleotide triphosphates, and a 3′ overhang region of 6-200 nucleotides; and

(b) labeling an oligonucleotide target sequence by denaturing the target sequence, adding excess template, the appropriate nucleotide triphosphates and polymerase in a suitable reaction medium.

10. The method of claim 9 wherein the most 3′ sequence is a random sequence of 6 to 12 nucleotides.

11. The method of claim 9 wherein said template is downstream from a promoter site, and a target sequence is further downstream from the promoter site in a suitable vector for cloning.

12. The method of claim 11 wherein said promoter site is the T3 promoter.

13. The method of claim 11 wherein said promoter site is the T7 promoter.

14. The method of claim 11 wherein said promoter site is the SP6 promoter.

15. The method of claim 7 wherein said method cogenerates oligonucleotides having complementarity to an optimally labeled sequence and a target sequence.

16. The method of claim 7 wherein said labeling step comprises primer extension.

17. The method of claim 7 wherein said labeling step comprises random priming methods.

18. An oligonucleotide comprising a nucleotide sequence complementary to a primer, and a nucleotide repeat region downstream from said complementary region, wherein said nucleotide repeat region comprises N^t, where N^t is any nucleotide which can form a base pair with the labeled-conjugated nucleotide triphosphate, said repeat region having the formula: $N^t\ N^t)_nN^t$ where n is an integer from 20 to 1000.

19. The oligonucleotide of claim 18 wherein said nucleotide repeat region comprises N, where N is any nucleotide which cannot form a base pair with the labeled-conjugated nucleotide triphosphate, and N^t, where N^t is any nucleotide which can form a base pair with the labeled-conjugated nucleotide triphosphate, said repeat region having the formula: $N^t (N_mN^t)_nN_m$ where n is an integer from 20 to 1000, and m is an integer from 1 to 11.

20. An oligonucleotide comprising a radiolabeled nucleic acid sequence and a nucleotide repeat region, said oligonucleotide having been prepared by the process of claim 1.

21. The oligonucleotide of claim 20 wherein said radiolabel is ^{32}P.

22. The oligonucleotide of claim 20 wherein said nucleotide repeat region has the formula: $N^f\ (N^f)_nN^f$ where N^f is any nucleotide which is conjugated to a label, and n is an integer from 20 to 1000.

23. The oligonucleotide of claim 20 wherein said nucleotide repeat region has the formula: $N^f\ (N_mN^f)_nN_m$ where N is any nucleotide which is not conjugated to a label, and N^f is any nucleotide which is conjugated to a label, n is an integer from 20 to 1000, and m is an integer from 1 to 11.

24. The oligonucleotide of claim 20 wherein said oligonucleotide is single-stranded.

25. The oligonucleotide of claim 20 wherein said oligonucleotide is double-stranded.